

Appl. No. 10/712,708
Amdt. dated April 16, 2007
Reply to Non-Compliant Amend Notice of March 16, 2007

PATENT

AMENDMENTS TO THE SPECIFICATIONS:

[0007] Through the design of the invention, since the shaft of the fan is made from materials with high thermal conductivity such as a heat pipe, the shaft can become a pivot of the entire heat dissipation mechanism and thus swiftly transfer the heat from the heating element to [[an]] a forced-convection flow area above the rotor where the heat sink is just situated. Thus, the heat absorbed by the heat sink is swiftly removed, and high heat dissipation within a limited space can be easily accomplished.

[0015] The base 20 made from materials with high thermal conductivity is formed with a hole 26 in its central location where one end 16a of the heat pipe 16 can be fit. A plurality of teeth 28 circularly arranged on the base 20 are served serve as a fan frame to protect the rotor 12. A clearance, formed between each two adjacent teeth 28, functions as an extra air inlet for the side airflow so as to increase air flow volume. The shape, allocation and number of the teeth 28 may be optimized according to the flow field; for example, it may be optimized to conform to a flow channel design. Furthermore, a plurality of bumps 30 made from materials with high thermal conductivity can also be formed on the base 20.

[0016] The heat sink 18 can be any shape, and the way it is connected to the heat pipe 16 is not restricted. For example, the heat sink 18 may be formed with an opening thereon where one end 16b of the heat pipe 16 is inserted, while the other end 16a of the heat pipe 16 contacts the base 20.

[0017] According to this embodiment, to assemble the heat dissipation module 10,

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firstly, the stator assembly 14 is fixed on the heat pipe 16, and then the rotor 12 is fit onto the heat pipe 16 through an opening 24 located in the central location of the hub 22. That is, the heat pipe 16 is used to pivotally join the rotor 12 and the stator assembly 14, and thus ~~served-~~ serves as a shaft of a fan structure. After that, the end 16a of the heat pipe 16 penetrating the hub 22 is inserted into the hole 26 of the base 20 so as to fix the heat pipe 16 on the base 20. The other end 16b of the heat pipe 16 is fit into the heat sink 18. Through the magnetic interaction, the rotor 12, when turning, can keep an appropriate float distance from the stator assembly 14 above the heat pipe 16 (i.e. the shaft).

[0018] FIG. 3 is a cross-sectional view showing the assembled heat dissipation module 10. Referring to FIG. 3, when the base 20 is stuck on a heating element such as a CPU 32, because one end of the heat pipe 16 is fixed on the base 20 and the other end is fit into the heat sink 18, heat can be swiftly transferred from the CPU 32 to the heat sink 18 through the heat pipe 16. At the same time, since the heat pipe 16, i.e. the shaft, ~~located~~ is located between the heat sink 18 and CPU 32, the airflow generated by the turning rotor 12 can swiftly remove the heat absorbed by the heat sink 18.

[0019] According to the invention, the heat pipe 16 is designed as a fan shaft, thus changing the essential design of a conventional fan structure to improve the heat dissipation. In other words, such design can not only make inherent components of a fan structure assist in heat dissipation, but also, when the fan structure cooperates with the heat sink in dissipating heat, improve the efficiency. Specifically, referring to the conventional cooperation between the fan and the heat sink shown in FIG. 1, after the heat sink 102 swiftly absorbs a great amount of heat, it is difficult for the fan 100 to

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promptly dissipate heat stored in the heat sink 102. Thus, the potential heat resistance between the heating element and the fan ~~rises~~ rises, hence impeding further improvement of the heat dissipation. However, through the design of the invention, the heat pipe 16 (i.e. the shaft), the pivot of the entire heat dissipation mechanism, can swiftly transfer heat from the heating element to [[an]] a forced-convection flow area above the rotor 12 where the heat sink 18 is just situated. Thus, the heat absorbed by the heat sink 18 is swiftly removed, and high heat dissipation within a limited space is accomplished.

[0020] Moreover, through this design, the teeth 28 may also be made from materials with high thermal conductivity. Thereby, once the teeth 28 are arranged ~~according to~~ according to [[the]] to form air flow paths between thereof, they ~~are served~~ serve as not only a fan frame but also as a heat sink. When both ends of the fan shaft connect to the heat sink 18 and the base 20, respectively, a multi-stage heat dissipation module with a heat pipe 16 accommodated therein is formed.

[0023] According to the invention, ~~the design of~~ the fan shaft adopts can be made from materials with high thermal conductivity such as a heat pipe 16, thus making inherent components of the fan structure assist in heat dissipation. For example, ~~when~~ while a fan shaft adopts is a heat pipe 16, it is also possible for the rotor 12 to adopt be made from materials with high thermal conductivity and low specific weight such as aluminum alloy. Thereby, heat generated from the heating element can be transferred to the rotor 12 through the shaft (i.e. the heat pipe 16), and the rotor 12 can be made to function as a heat sink. Also, the high rotational speed of the rotor 12 can facilitate excellent heat dissipation. The rotor 12 and the heat sink 18 that are both

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made from materials with high thermal conductivity also form a multi-stage heat dissipation module with a heat pipe 16 accommodated therein, further improving the heat dissipation.

Abstract

A heat dissipation module includes a fan and a heat sink. The shaft of the fan, made from materials with high thermal conductivity or being a heat pipe, has a first end and an opposite second end. [[,]] with the The first end of the shaft penetrating penetrates a fan hub and connects connecting to a heating element. The heat sink is connected to the second end of the shaft.